Claims

1. (Currently amended) A cold hearth melting and refining arrangement comprising:

a cold hearth configured to hold a pool of molten material;

a first electron gun, wherein the first electron gun's geometric position relative to the cold hearth and the first electron gun's power specifications namely voltage, current and pulse rate specifications are selected so that an electron beam generated by the electron gun can deliver sufficient power to the surface of the pool of molten material to keep the material therein in its molten state

a skull wing inhibiting configuration comprising ~~an~~ a second electron gun and a programmable device coupled to the electron gun, wherein the second electron gun's geometric position relative to the cold hearth and the second electron gun's power specifications namely voltage, current and pulse rate specifications are selected so that the skull wing inhibiting configuration can provides an electron beam that sweeps along at least a portion of the perimeter of the pool of molten material to inhibit formation of skull wings at the edges of the pool of molten metal.

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2. (Currently amended). The cold hearth melting and refining arrangement of claim 1, wherein the programmable device comprises a program which can be executed so the skull wing inhibiting configuration provides an electron beam that continuously sweeps along at least a portion of the perimeter of the pool of the pool of molten material to inhibit formation of skull wings at the edges of the pool of molten metal.

3. (Currently amended). The cold hearth melting and refining arrangement of claim 2, wherein the programmable device comprises a program which can be

executed so that the skull wing inhibiting configuration provides an electron beam that circumscribes the portion of the perimeter of the pool of molten material with a time period that is in the range of about one millisecond to about several seconds.

4. (Currently amended). The cold hearth melting and refining arrangement of claim 1, wherein the programmable device comprises a program which can be executed so that the skull wing inhibiting configuration provides an electron beam that sweeps along at least a portion of the perimeter of the pool of molten material in a step-and-scan mode.

5. (Currently amended). The cold heart melting and refining arrangement of claim 4 wherein the programmable device comprises a program which can be executed so that the skull wing inhibiting configuration provides an electron beam that has a dwell time at a spot between steps is in the range of about one millisecond to about hundreds of milliseconds.

6. (Currently amended). The cold hearth melting and refining arrangement of claim 1 wherein the programmable device comprises a program which can be executed so that the skull wing inhibiting configuration provides an electron beam that delivers energy to clear the portion of the perimeter of the pool of molten material of volatile impurities that evaporate from the pool of molten material and recondense on the perimeter.

7. (Currently amended). A method of cleaning a perimeter of a pool of molten material in a cold hearth melting and refining arrangement, comprising

utilizing an electron gun to generate an electron beam; and

using a programmable device to automatically sweeping a portion of the perimeter of the liquid pool with the electron beam so that volatile impurities that evaporate from the pool of molten material and recondense on the perimeter are dispersed.

8. (previously presented) The method of claim 7 wherein sweeping a portion of the perimeter of the liquid pool with the electron beam comprises continuously sweeping the electron beam along at least a portion of the perimeter of the liquid pool.

9. (previously presented) The method of claim 7 wherein sweeping a portion of the perimeter of the liquid pool with the electron beam comprises circumscribing the portion of the perimeter of the pool of molten material with the electron beam in a time period that is in the range of about one millisecond to about several seconds.

10. (previously presented) The method of claim 7 wherein sweeping a portion of the perimeter of the liquid pool with the electron beam comprises sweeping the electron beam in a step-and-scan mode.

11. (previously presented) The method of claim 10 wherein sweeping the electron beam in a step-and-scan mode comprises using an electron beam with a dwell time in the range of about one millisecond to about hundreds of milliseconds at a spot between steps.

12. (previously presented) The method of claim 7 wherein sweeping a portion of the perimeter of the liquid pool with the electron beam comprises using an electron